Claims

1) A method of scheduling upstream data for frame based communication between a plurality of terminals 20 and a master controller 10, the method comprising the steps of:

a) providing a plurality of concentration elements for local scheduling of upstream data;

b) partitioning the plurality of concentration elements and the plurality of terminals over a plurality of cells distributed on a multiple hierarchical level star topology, each cell belonging to a hierarchical level N, where N is comprised between a top level, corresponding to a single cell to which the master controller is assigned, and a bottom level;

c) in each cell at level N, selecting one concentration element to be the master element for the cell and selecting the remaining concentration elements and terminals in said cell to be slave elements of the master element for the cell;

d) each master element in a cell at level N being in turn a slave of the master element in one of the cells at level $N+1$, the master element at the top level being the master controller;

e) defining at least one flow service category;

f) at each master element at level N, collecting uplink aggregate requests and flows originating from the slave elements thereof and, for each service category, aggregating flows into one aggregated flow generating new uplink requests for each flow, which are input to the master element at level $N+1$ to which the master element at level N is slave.

2) The method of claim 1, further comprising the step of, at each master element, allocating bandwidth to each connected slave according to said new uplink aggregate requests and to the available bandwidth.

3) The method of claim 2, characterised in that the method is based on a polling mechanism.

4) The method of claim 3, further comprising the step of, at each master element, recalculating requests for each aggregate flow at each polling period or multiple thereof.

5) The method of claim 4, further comprising the steps of, at each slave element at level N, aggregating flows according to said flows categories and, at each polling period, sending aggregate bandwidth requests to the corresponding master element at level $N+1$.

6) The method of any of claims 2 to 5, further comprising the steps of reserving a first portion of the upstream frame for the storing of bandwidth request information, the size of said first portion of the frame being sufficient to address all the slots in the frame.

7) The method of any of claims 2 to 5, further comprising the steps of:

- reserving a first portion of the frame for the storing of bandwidth request information, the size of the said first portion of the frame being sufficient to address $RTT + (N_{RG} - 1)$ slots in the frame, wherein RTT is the Round Trip Time and N_{RG} is the number of different request groups in a terminal, and
- piggybacking the remaining request information on traffic slots in the upstream frame.

8) The method of any of the preceding claims, characterised in that the bandwidth request information comprises guaranteed bandwidth requirements and excess bandwidth requirements.

9) The method of claim 8, further comprising the step of:

- at each master element, integrating the requests of granted bandwidth over a time window of length *IT*, where *IT* is an integer multiple of the polling time period, so as to dynamically adjust the guaranteed quote for a slave element.

10) A distributed scheduler for frame based communication between a plurality of terminals 20 and a master controller 10, comprising:

a plurality of concentration elements for local scheduling of upstream data, the plurality of concentration elements and the plurality of terminals being partitioned over a plurality of cells distributed on a multiple hierarchical level star topology, each cell belonging to a hierarchical level *N*, where *N* is comprised between a top level, corresponding to a single cell to which the master controller is assigned, and a bottom level;

at each cell at level *N*, one concentration element being the master element for the cell and the remaining concentration elements and terminals in said cell being slave elements of the master element for the cell;

each master element in a cell at level *N* being in turn a slave of the master element in one of the cells at level *N* +1, the master element at the top level being the master controller;

each master element at level *N* comprising means for collecting uplink aggregate requests and flows originating from the slave elements thereof and means for generating an aggregate flow and aggregate uplink requests, which are input to the master element at level *N* +1 to which the master element at level *N* is slave.

11) The scheduler of claim 10, further comprising, at each master element, means for allocating bandwidth to each connected slave according to said aggregate requests and to the available bandwidth.

12) The scheduler of claim 11, characterised in that it comprises polling means.

13) The scheduler of claim 12, characterised in that said polling means, at each master element, are set so as to recalculate aggregate requests at each polling period or multiple thereof.

14) The scheduler of claim 13, further comprising, at each slave element at level N, aggregating flows means which aggregate flows according to said flows categories and, at each polling period, send aggregate bandwidth requests to the corresponding master element at level $N+1$.

15) The scheduler of any of claims 11 to 14, characterised in that a first portion of the upstream frame stores bandwidth request information, the size of said first portion of the frame being sufficient to address all the slots in the frame.

16) The scheduler of any of claims 11 to 14, characterised in that:

- a first portion of the frame is reserved for the storing of bandwidth request information, the size of the said first portion of the frame being sufficient to address $RTT + (N_{RG} - 1)$ slots in the frame, wherein RTT is the Round Trip Time and N_{RG} is the number of different request groups in a terminal, and
- the remaining request information on traffic slots is piggybacked in the upstream frame.

17) The scheduler of any of the preceding claims, characterised in that the bandwidth request information comprises guaranteed bandwidth requirements and excess bandwidth requirements.

18) The scheduler of claim 17, further comprising, at each master element, means for integrating the requests of granted bandwidth over a time window of length *IT*, where *IT* is an integer multiple of the polling time period, so as to dynamically adjust the guaranteed quote for each slave element.